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(54) Ratchet

(57) In order to provide a ratchet which can be made from inexpensive parts, it comprises a pair of discs (5 and 6) having ramps (5*a*, 6*a*) upset from a peripheral zone of the discs and terminating in shoulders (5*b*, 6*b*). The discs are loaded together by a spring 9 which enables the drive to be transmitted via the faces of the ramps (5 and 6) up to a predetermined limit before the discs separate and the ratchet clicks over. In the opposite direction the drive is transmitted through the shoulders (5b, 6b), which may then be inclined to provide a torque limitation. The ratchet may for example be used in wheel braces or in spark plug spanners.

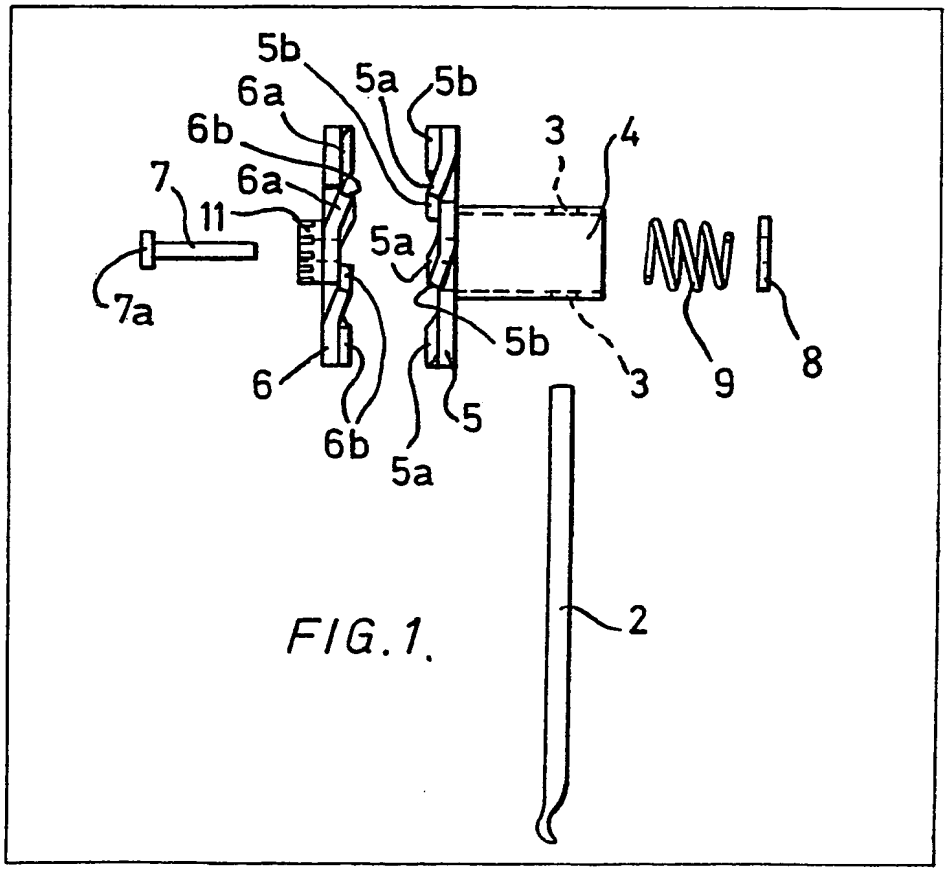

FIG. 1.

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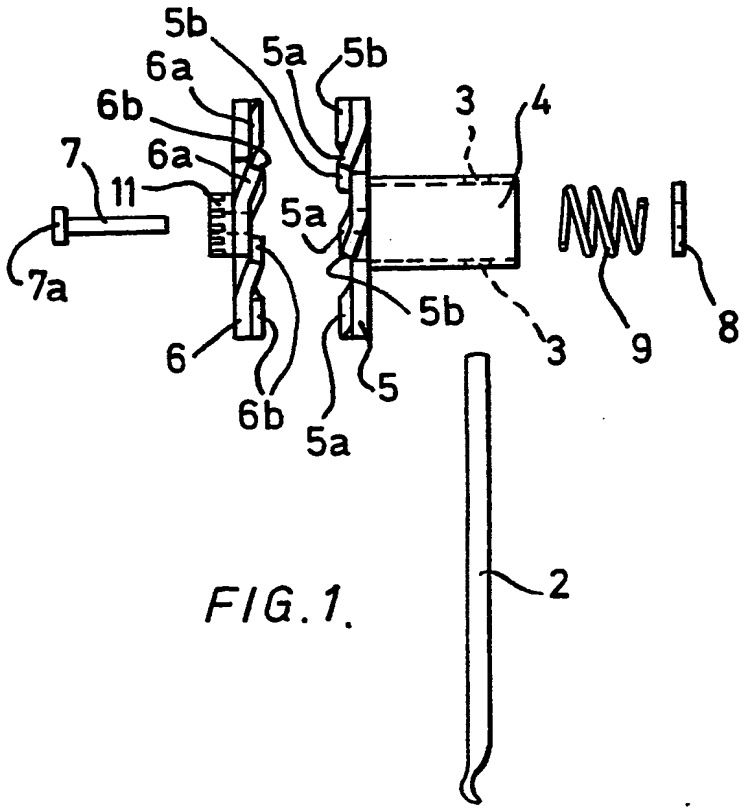
5b
5a
5b
6a
6b
6a
7
11
7a
5a
3
4
5b
3
9
8
6
6b
5a
5
2

FIG. 1.

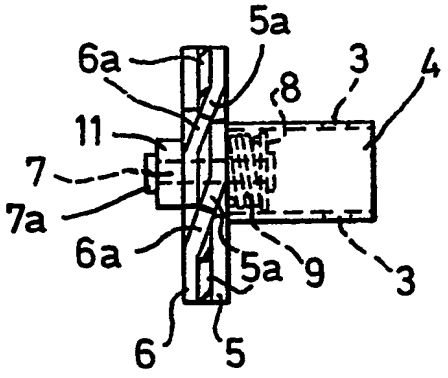
5a
6a
8
3
4
11
7
7a
6a
5a
9
3
6
5

FIG. 2.

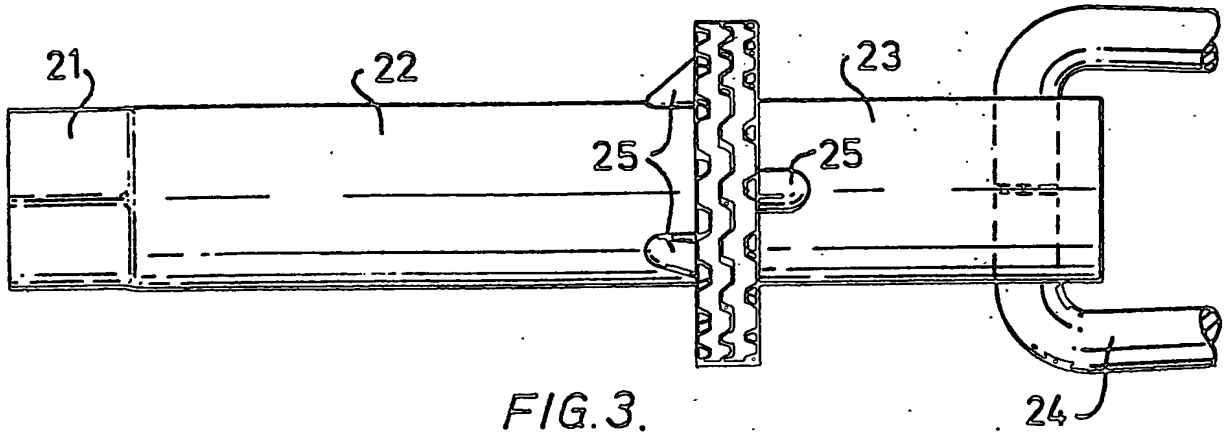

FIG. 3.

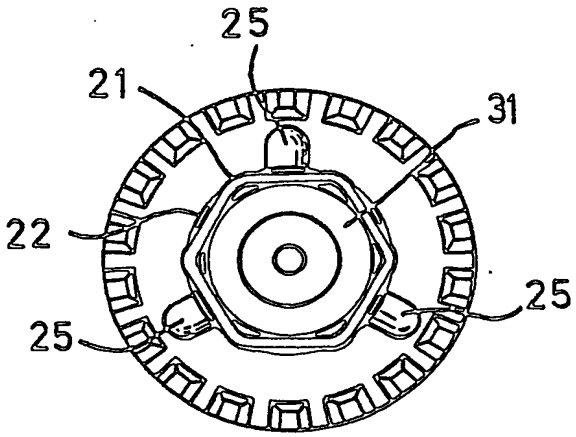

FIG. 4.

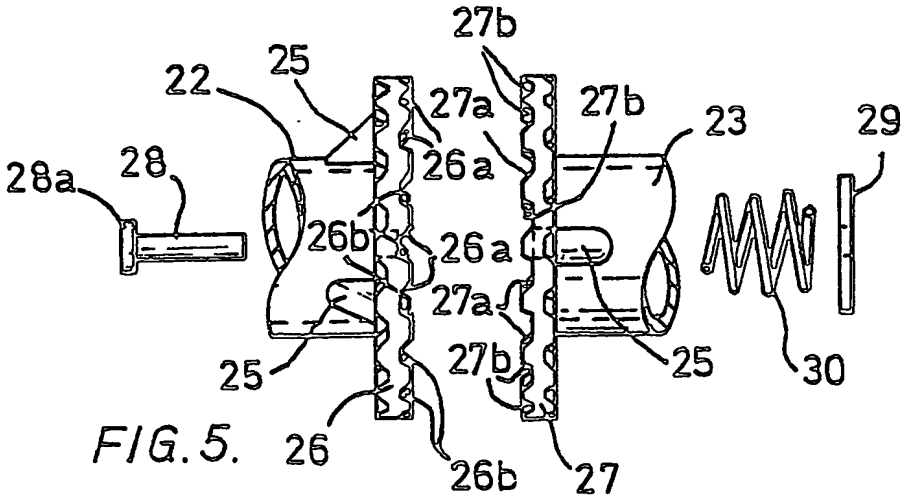

FIG. 5.

SPECIFICATION
Ratchet

This invention relates to ratchets with torque-limiting characteristics.

In a number of engineering applications, e.g. wheel braces or spark plug spanners, it is required to transmit all the available torque in one direction of rotation, while being able to limit the torque transmitted in the opposite direction e.g. to prevent overtightening.

Mechanisms for performing this function are already known, but normally comprise expensive components.

It is an object of the invention to provide a torque limiting ratchet which may be made reasonably inexpensive.

In accordance with the invention, there is provided a torque limiting ratchet comprising a pair of discs arranged face-to-face and spring loaded together, the discs each having a series of pressed-out ramps terminating in shoulders, with the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating on the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the limit imposed by the spring loading.

Our co-pending application No. filed simultaneously herewith, claiming priority from application No. 8203216 and entitled "Wheel Brace" discloses the use of a ratchet of this type in connection with a wheel brace.

It has previously been proposed, for example in published United Kingdom Patent application 2062524, to provide a spark plug spanner with a torque limiting ratchet. However, the constructions proposed have necessitated interengaging sets of teeth and as such, the precision of the engineering required has meant that the cost is too great for the device to obtain ready acceptance. Also, the torque limiting ratchet is not built into the spanner as such but has to be attached thereto.

In accordance with another aspect of the present invention, there is provided a spark plug spanner including a torque limiting ratchet comprising a pair of discs arranged face-to-face and spring loaded together, the discs each having a series of pressed-out ramps terminating in shoulders, with the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating in the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the limit imposed by the spring loading.

In accordance with a further aspect of the present invention, there is provided a spark plug spanner including a first body portion to be turned by the user, a second body portion to turn a plug and, a torque limiting ratchet comprising a pair of discs arranged face-to-face and spring loaded together, one of the discs being attached to each of the first and second body portions, the discs each having a series of pressed-out ramps terminating in shoulders, with the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating in the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the limit imposed by the spring loading.

In all uses the shoulders may be somewhat inclined so that there is a torque limit in both directions.

The invention will be further described with reference to the accompanying drawings of which:—

Figure 1 is an exploded view of a ratchet device in accordance with a preferred embodiment of the invention;

Figure 2 is a sectional view showing the ratchet device assembled;

Figure 3 is a side elevation of a spark plug spanner including a ratchet in accordance with one form of the invention;

Figure 4 is an end elevation of the spanner of Figure 3; and

Figure 5 is an exploded view of the ratchet device shown in Figure 3.

The structure illustrated in Figure 1 includes some parts to form a wheel brace such as that described in our above mentioned co-pending application. The wheel brace is driven by a handle or tommy bar 2 engaged in aligned holes 3 in a tube 4. The handle or tommy bar 2 may be separate or welded in position in the holes 3. The tube 4 is welded to a first ratchet disc 5 which is in face-to-face relationship with a second ratchet disc 6, as shown in Figure 2. A pin 7 passes axially through both ratchet discs, with its head 7*a* against the disc 6, and carries a spring abutment plate 8 so that when assembled a spring 9 is compressed between the plate 8 and the rear of the ratchet plate 5 so as to spring load the ratchet plates together.

The ratchet plates 5 and 6 are formed with ramps 5*a*, 6*a*, upset from the metal of the disc in the peripheral region thereof, so as to provide each ratchet disc with a series of similarly facing ramps terminating in shoulders 5*b*, 6*b* respectively. The ramps are in opposition on the two ratchets discs so that when the tube 4 and ratchet disc 5 are rotated in one direction, the shoulders 5*b* and 6*b* come into engagement, as shown in Figure 2, and transmit the full torque to the ratchet plate 6. When rotated in the opposite direction, the ratchet disc 5 rotates somewhat until the faces of the ramps 5*a* are in engagement with the faces of the ramps 6*a*, and torque is transmitted through these faces. Should the torque become excessive, the ramps 6*a* will be forced, against the action of the spring 9, in an axial direction away from the disc 5 and the ratchet mechanism will slip round. The actual

limiting torque will depend upon the angles of the ramps 5*a* and 6*a* and on the characteristics of the spring including the amount of initial compression applied to it in the initial position shown in Figure 2.

Attached to the ratchet 6, e.g. by welding, is a sun gear 11 forming a drive for an epicyclic system (not shown).

In operation, the tommy bar or handle 2 is rotated in the appropriate direction. In the direction to apply full torque, this is transmitted through the shoulders 5*a* and 6*b* of the ratchet and in the opposite direction e.g. to tighten the nuts of a vehicle wheel the torque limiting feature of the ratchet comes into play and the torque required is transmitted through the faces of the ramps 5*a* and 6*a*.

The shoulders 5*b* and 6*b* may be somewhat inclined so that a torque limiting feature applied in the reverse direction of rotation, e.g. to protect the mechanism of the wheel brace or other tool against abuse.

Turning now to Figures 3 and 4, the plug spanner illustrated has a conventional hexagonal socket 21 at the outer end of a tubular body member 22, and at the opposite end, a tubular body member 23 is provided with a stirrup 24 pivotally received in appropriate holes near the end of the tubular member 23.

In a conventional plug spanner, the tubular body elements 22 and 23 are part of a single tube, but in accordance with the present invention, the tubular body members 22 and 23 are each attached, e.g. by welds 25 to a respective ratchet disc 26 or 27.

As shown more particularly in Figure 5, the tube 22 is welded to a first ratchet disc 26 which is in face-to-face relationship with the second ratchet disc 27 to which the tube 23 is welded, as shown in Figure 4. A pin 28 passes axially through both ratchet discs 26 and 27, with its head 28*a* against the disc 26, and is peened over a spring abutment plate 29 so that, when assembled, a spring 30 is compressed between the plate 29 and the rear of the ratchet disc 27 so as to spring load the ratchet discs 26 and 27 together.

The ratchet discs 26 and 27 are each formed with a plurality of equi-spaced ramps 26*a* and 27*a* upset from the metal of the disc in the peripheral region thereof, so as to provide each ratchet disc with a series of similarly facing ramps terminating in shoulders (or more steeply inclined ramps) 26*b* and 27*b* respectively. The ramps are in opposition on the two ratchet discs so that when the tubular member 23 and ratchet disc 27 are rotated in one direction, the shoulders 26*b* and 27*b* come into engagement and transmit the full torque (or up to a very high torque) to the ratchet plate 26. When rotated in the opposite direction, the ratchet disc 27 rotates somewhat until the faces of the ramps 27*a* are in engagement with the faces of the ramps 26*a*, and torque is transmitted through these faces. Should the torque become excessive, the ramps 26*a* will ride over the ramps 27*a* and the ramps will be forced apart against the action of the spring 29, so that the ratchet mechanism will slip round. The actual limiting torque will depend upon the angles of the ramps 26*a* and 27*a* and on the characteristics of the spring, including the amount of initial compression applied to it in the initial position shown in Figure 4.

It will be seen from Figure 2 that the plug spanner is shown as including a rubber or like soft insert 31 which lightly grips a plug over which the spanner has been introduced so that the spanner may also be used to lift the plug clear of the engine and also to introduce the plug into the engine when required.

Various modifications may be made within the scope of the invention.

CLAIMS

1. A torque limiting ratchet comprising a pair of discs arranged face-to-face and loaded together by a spring up to a predetermined limit, the discs each having a series of pressed-out ramps terminating in shoulders, the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating on the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the required limit imposed by spring loading.

2. A ratchet as claimed in claim 1, in which the ramps are upset from a peripheral zone of the respective discs.

3. A ratchet as claimed in claim 1 or 2, in which a driving tube for one plate acts as a housing for the spring loading the plates together.

4. A ratchet as claimed in claim 1, 2 or 3, in which the shoulders are formed by ramps more steeply inclined than the first mentioned ramps so as to present a torque limitation in the loosening direction.

5. A torque limiting ratchet substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

6. A spark plug spanner including a torque limiting ratchet as claimed in any of claims 1 to 5.

7. A spark plug spanner including a torque limiting ratchet comprising a pair of discs arranged face-to-face and spring loaded together, the discs each having a series of pressed-out ramps terminating in shoulders, with the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating in the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the limit imposed by the spring loading.

8. A spark plug spanner as claimed in claim 7, in which the shoulders are formed by ramps more steeply inclined than the first mentioned ramps so as to present a torque limitation in the loosening direction.

9. A spark plug spanner including a first body

portion to be turned by the user, a second body portion to turn a plug and a torque limiting ratchet comprising a pair of discs arranged face-to-face and spring loaded together, one of the discs being attached to each of the first and second body portions, the discs each having a series of pressed-out ramps terminating in shoulders, with the ramps of each series facing the same way and being in opposition to the ramps of the other series so that when rotating in the loosening direction the torque is transmitted *via* the shoulders, and when rotating in the tightening direction the torque is transmitted *via* the faces of the ramps up to the limit imposed by the spring loading.

10. A spark plug spanner as claimed in claim 9, in which the shoulders are formed by ramps more steeply in inclined than the first mentioned ramps so as to present a torque limitation in the loosening direction.

11. A spark plug spanner substantially as hereinbefore described with reference to Figures 3, 4, and 5 of the accompanying drawings.

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